PHYSIOLOGY OF GASTRIC DIGESTION.

THE foundations of our knowledge of the physiology of gastric digestion were undoubtedly laid by the careful study of the historical case of gastric fistula by Dr. Beaumont — the case of Alexis St. Martin. Animal experimentation and the test-tube reactions of the laboratory cannot be compared in accuracy to observations made directly upon the living human organism, when these rare opportunities arise which permit of such a study. Then, too, it may happen that a considerable rectification of current physiological doctrine has to be made, and the laboriously gathered results of many observers have to be replaced by those made upon a single case. Much depends, then, upon the skill and thoroughness with which the study of the processes in the human subject are undertaken.

It must be admitted that these qualities are conspicuous in the recently published records of a study of the chemical processes of the small intestine by Drs. McFadden, Nencki, and Sieber. The subject of their researches, says *Lancet*, was a female patient under the care of Professor Kocher, in whom an intestinal fistula had resulted from excision of a portion of gangrenous intestine due to strangulated hernia. The false anus was situated in the ileum just above the ileo-cæcal valve, so that the materials escaping thereby were wholly composed of the chyme which had passed through the whole length of the small intestine. For a period of nearly six months the woman lived under these conditions, permitting of a long series of observations relative to the time and character of intestinal digestion under varying forms of diet, etc. At the end of that time Professor Kocher re-established the natural channel by means of an operation which proved perfectly successful. It may be remarked at once that during the whole period when there was practically no large intestine the patient gained in weight, and, as the urinary analysis showed, eliminated a fairly normal quantity of urea.

The procedure consisted in adapting a flexible tube to the fistulous outlet, so as to collect all the material that escaped, and to note its characters under varying circumstances. In consistency this "chyme"— if it may be so termed — was more fluid and diarrhœal when the diet was albuminous than when it was mainly of a vegetable nature. It was seen that the flow of chyme from the small into the large intestine is steadily continuous, being least marked during the night, owing to no food being then taken; and by some ingenious experiments (e.g., the addition of hard beans to the food, or of salol, which allowed of the detection of salycylic acid in the matters escaping) it was shown that the passage of foods from mouth to cæcum occupies at the least two hours: but all traces of the substances introduced did not disappear for from nine to fourteen or even twenty-three hours. The rate of flow, of course, bears much relation to the consistency of the intestinal contents. As regards the nature and properties of the evacuated materials, it is noticeable that they were almost free from odor, containing hardly any products of albuminous disintegration, such as indol and sulphuretted hydrogen; they were slightly acid in reaction, tinged yellow by bilirubin, and, according to the predominance of flesh or starchy matter in the food, showed muscle fibre, albuminous granules, vegetable fibres, starch granules, etc., and invariably a large number of various forms of bacteria. The filtrate yielded albumen, mucin, peptone, dextrose, the two forms of lactic acid, acetic acid, and the biliary acids and bilirubin.

The authors enter very fully into the characters of the bacteria they find, many forms being special to the small intestine, others existing also in the mouth; but, passing over these, which would entail a full description to be intelligible, we may glance at the main results of their researches, which somewhat modify accepted physiological teachings. One point of interest is the fact that albumen is hardly, if at all, decomposed in the small intestine. Even the action of the tyrosin of the pancreatic juice is small, for leucin and tyrosin were not to be found. Probably, in health, albuminous disintegration takes place chiefly in the large intestine, and it is only in disease that it occurs in the stomach or small intestine. Amongst the products of such decomposition are iodol, skatol, phenol, sulphuretted hydrogen, carbonic acid, methylmercaptan, etc., all of which may be regained from the large intestine. The bacteria of the small intestine are concerned in the disintegration of the carbo-hydrates into lactic, acetic, and succinic acids, and also into ethylic alcohol. The authors, in noting this last-named fact, cannot avoid a thrust at the total abstainers. It is generally believed that the chyme is rendered alkaline by the secretien of the small intestine, but they find that, owing probably to the reinforcement of gastric acidity by the organic acid resulting from sugar, the total quantity of acid is more than can be neutralized by the bile, pancreatic, and intestinal juices. If, however, the alkalinity of these fluids be diminished, the intestinal contents are hyper-acid, and mucin is precipitated instead of being intermingled with the chyme. This explained the diarrhœal quality of the evacuations noted to be associated with a large amount of sugar and organic acid in the chyme. On the other hand, an excess of alkalinity favors putrefactive decomposition, the acids apparently holding in check the bacteria concerned in albuminous disintegration. A marked contrast in this respect was exhibited between the small and large intestine. Putrefactive bacteria could hardly be at all isolated from the former, whilst they abounded in the latter; but this is not owing to the influence of bile, which Nencki showed to have no real antiseptic property.

The part played by bacteria in intestinal digestion is limited probably to the fermentation of sugar and carbo hydrates generally, the excess of acid resulting from this fermentation being neutralized by the alkaline intestinal juice. But, much as bacterial life abounds in the intestinal canals, varying according to the kind and quality of the ingesta, it does not appear that the processes initiated by these organisms are of such value or importance in nutrition as the chemical ferments. Certainly the patient who was the subject of these observations gained in flesh, although for six months she was deprived of all the bacterial processes that go on in the large intestine.

OCEAN CURRENTS AND TEMPERATURES IN EAST ASIATIC WATERS.

UNDER this title Dr. Gerhard Schott contributes to a recent number (ix.) of *Petermann's Mitteilungen* an interesting paper, which contains new information regarding the course of the Kuro-Shiwo and other currents in Chinese waters, and also as to ocean temperatures. The conclusions arrived at by the author are based upon researches made by him among the archives — principally ships' journals — of the German Admiralty, which contain observations of great value to science. With regard to the Kuro-Shiwo, the general result of Dr. Schott's researches, says the Proceedings of the Royal Geographical Society, is that this great ocean current is not so extensive as hitherto supposed. Throughout the whole of the year the warm stream is confined as a constant current exclusively to the west side of the line of islands,